



What is transmutation?

Transmutation changes one isotope to another

Transmutation is the conversion of one *isotope* to another by changing its structure. Changing one isotope to another changes its nuclear properties and (if the chemical element is changed as well) its chemical properties. Transmutation can be used to destroy long-term hazardous elements such as *transuranic elements* while creating energy.

Create energy

In a nuclear power plant, neutrons strike elements such as uranium and plutonium. Under proper conditions, these elements split, or *fission*, into two or three “fission products,” two or three neutrons, and energy. The fission products are waste. The neutrons keep the fission reaction going. The energy is converted into heat, turning water into steam, which then drives a turbine generator to produce electricity. Transmutation can also occur when an atom captures or absorbs a neutron. This is the primary way in which transuranics are created in *Light Water Reactors*.

Consuming hazardous materials

Used nuclear fuel from *Light Water Reactors* contains uranium (94%), *transuranic elements* (1%), and waste fission products (<5%). The transuranic elements contain the most stored energy, are the longest-lived hazardous elements, and can be used in nuclear weapons. The throw-away approach to managing used fuel accumulates such liabilities as transuranics. The recycle approach instead extracts energy from transuranics, thereby making them energy assets instead of waste liabilities. In *Advanced Burner Reactors*, some of the transuranics are consumed directly by fission, some by neutron capture followed by fission.

The easiest source of energy to recover from used fuel is the ~500 tonnes of plutonium in U.S. used fuel that has already accumulated; it has energy equivalence of 6.6 billion barrels of oil, which is half the estimated resources in Prudhoe Bay, Alaska.

